Columbia/Snake River Mainstem TMDL

Pulp and Paper Briefing

Portland, OR

May 1, 2002

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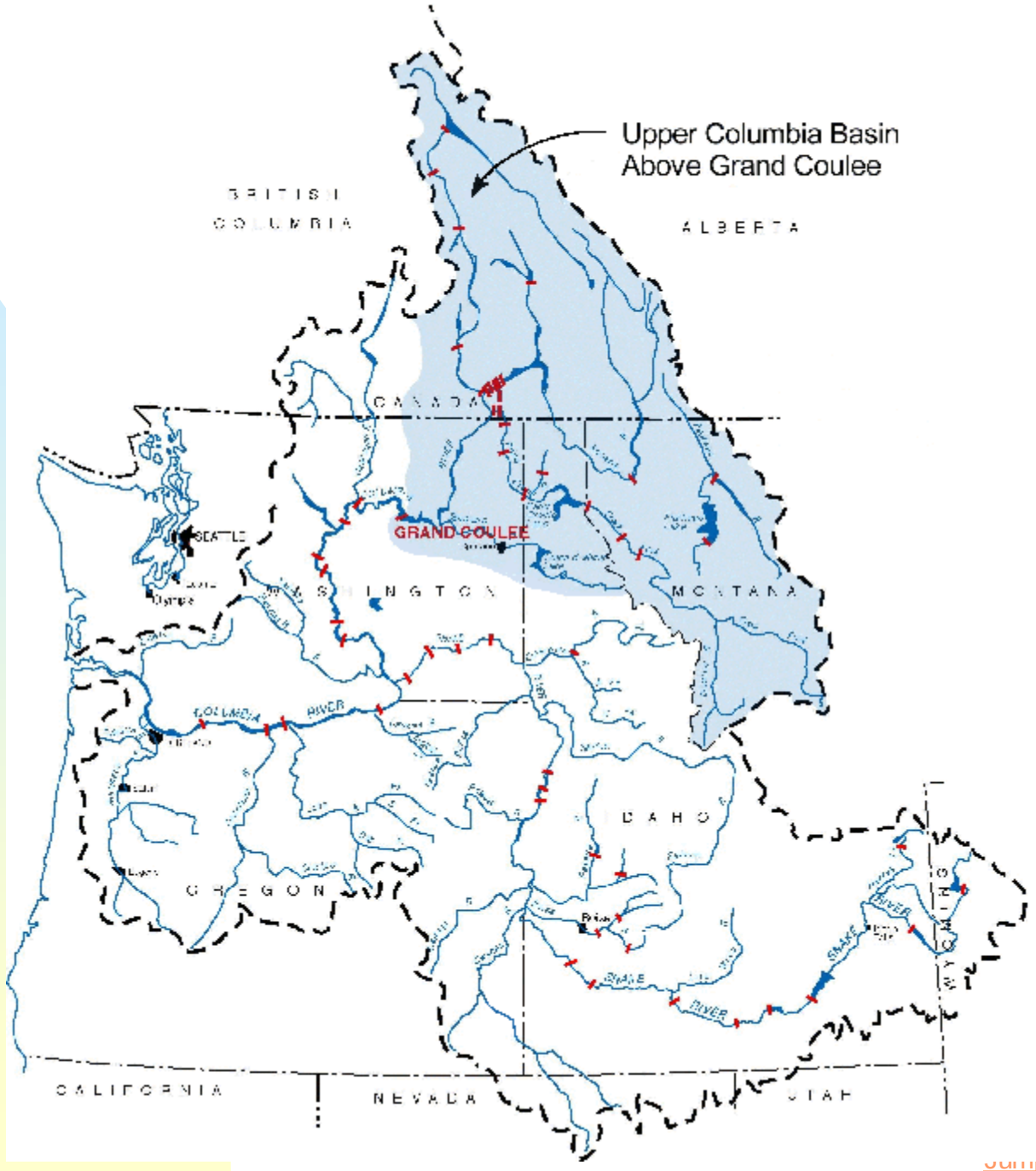

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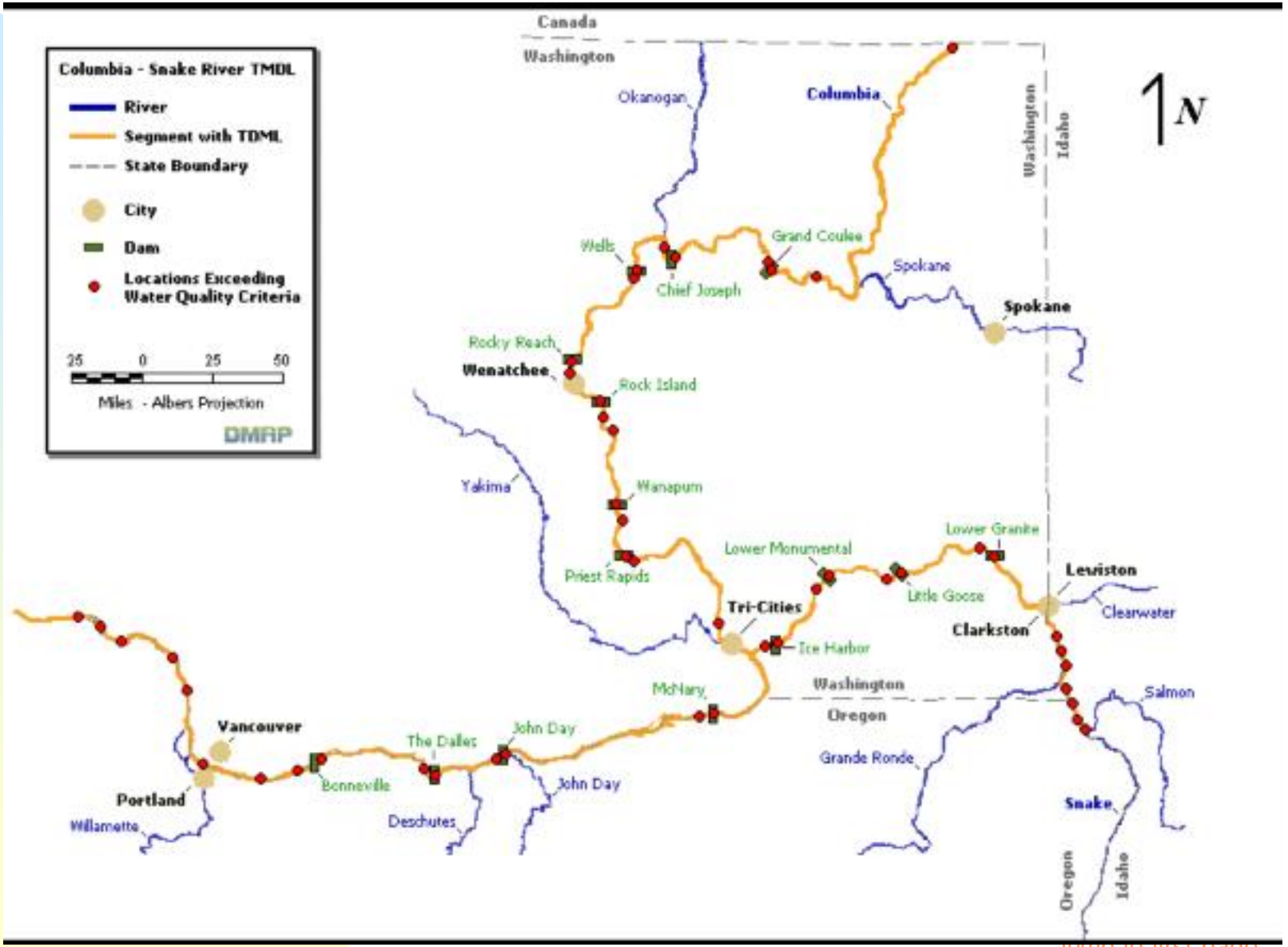
Geographic Scope



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Important Points

- Site Potential Temperatures
- Target Temperatures = Average Site Potential + increment from WQS
- The downstream WQS are more restrictive and drive the TMDL target temperatures in the mid-Columbia.
- The Load is expressed as Temperature
- The Loading Capacity = the Target Temperature @ RM 4
- Temperature available for allocation is the WQS increment.
- Tributary loads are established at their existing temperatures.
- Loads for existing point sources are established at their existing loads

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Water Quality Standards

The WQS for this TMDL are the natural temperatures of the Columbia and Snake main stems plus small incremental increases due to human activity.

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Water Quality Standards

Columbia Main Stem from Coast to OR/WA Border:

"Temperature shall not exceed 20 C (68 F) due to human activities. When natural conditions exceed 20 C (68 F) no temperature increases will be allowed which will raise the receiving water temperature by greater than 0.3 C (0.5 F) nor shall such temperature increases at any time exceed 0.3 (0.5 F) due to a single source or 1.1 C (2.0 F) due to all such activities combined."

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Water Quality Standards

Natural stream temperatures for this TMDL are those that would occur in the main stems within the TMDL study area in the absence of human activity within the main stems in the study area.

They are termed <u>site potential</u> temperatures in this TMDL.

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Water Quality Standards

OR - allow an increase of 0.14 C when the SP > criteria,

- allow increase up to criteria when SP < criteria.

WA & Colvilles

- allow an increase of 0.3 C when the SP > criteria,

-allow reach dependent increases when SP < criteria. Eg t=23/(T+5) is the increase allowed in L. Roosevelt.

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Snake River Target Temperatures

River Reach	Criterion	SP<Criterion	SP>Criterion
Salmon River to OR/WA Border			
	12.8/17.8 C	Up to Criterion	SP + 0.14 C
OR/WA Border to Clearwater River			
	20 C	SP +1.1 C	SP + 0.3 C
Clearwater River to Mouth			
	20 C	SP + 34/(T+9)	SP + 0.3 C

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Columbia River Target Temperatures

River Reach	Criterion	SP<Criterion	SP>Criterion
Canadian Border to Grand Coulee			
	16 C	SP + 23/(T+5)	SP + 0.3 C
Grand Coulee to Chief Joseph			
	16 C	SP + 23/(T+5)	SP + 0.3 C
Chief Joseph to Priest Rapids			
	18 C	SP + 28/(T+7)	SP + 0.3 C
Priest Rapids to OR/WA Border			
	20 C	SP + 34/(T+9)	SP + 0.3 C
OR/WA Border to the Mouth			
	20 C	**SP + 1.1 C**	**SP + 0.14 C**

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Determine Target Temperatures

1. Determine the Site Potential (SP) Temperatures

2. Apply the WQS for each reach.

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Site Potential Temperatures

The site potential temperatures vary temporally and geographically. They vary from day to day and from year to year and they vary along the length of the river.

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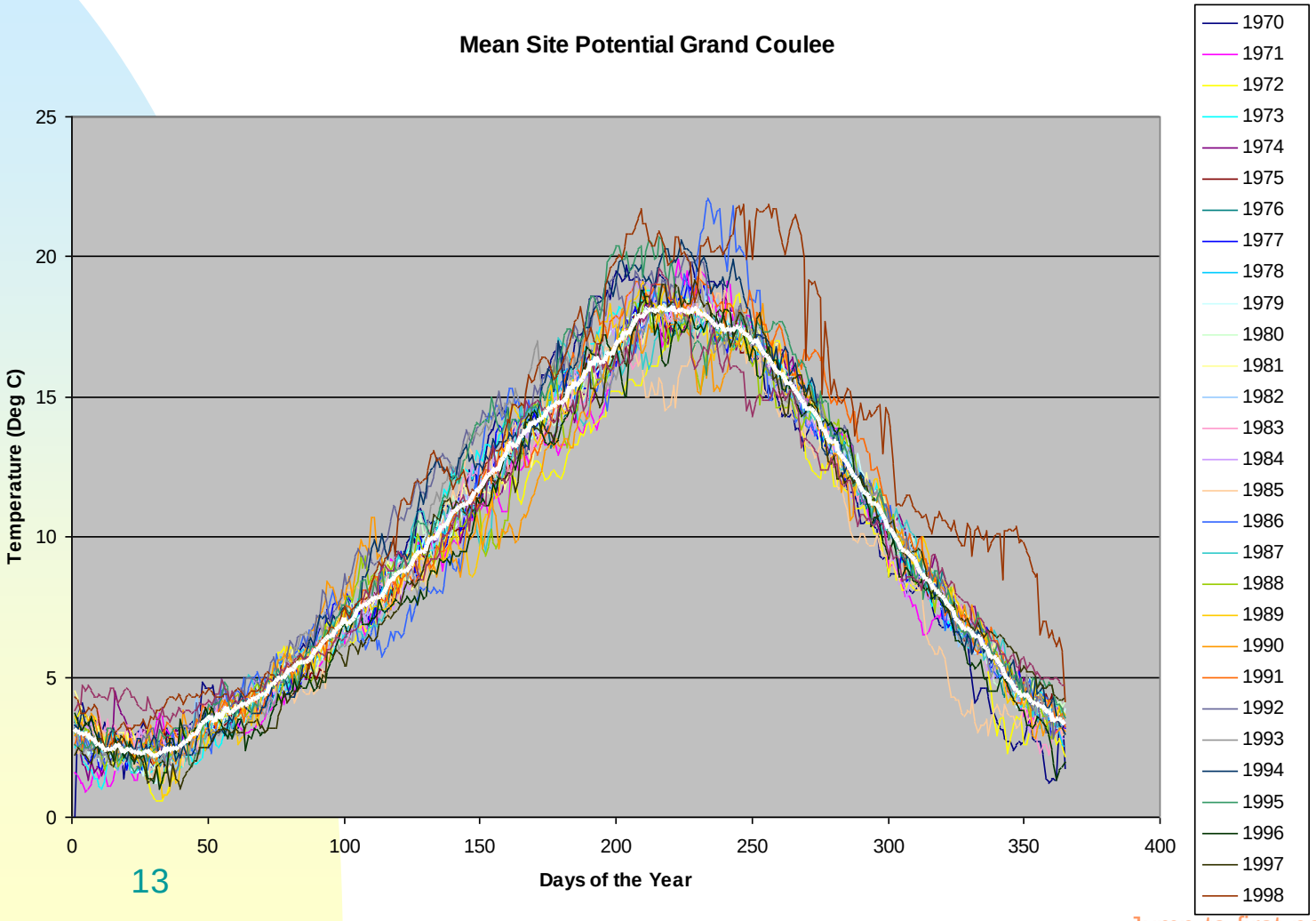
To account for this variability we utilize the mean daily site potential temperatures based on 30 years of simulations using actual weather and flow data.



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Site Potential Temperatures

•We have simulated Site Potential Temperatures for River Reaches.

•The reaches are defined by the dams and clusters of point sources. There are 19 reaches. The target sites for the dam reaches are in the tailraces of the dams at the foot of the reach. There are 4 other target sites between Bonneville dam and the mouth.

•We have calculated the mean site potential (30 year mean) for each day of the year at each target site.

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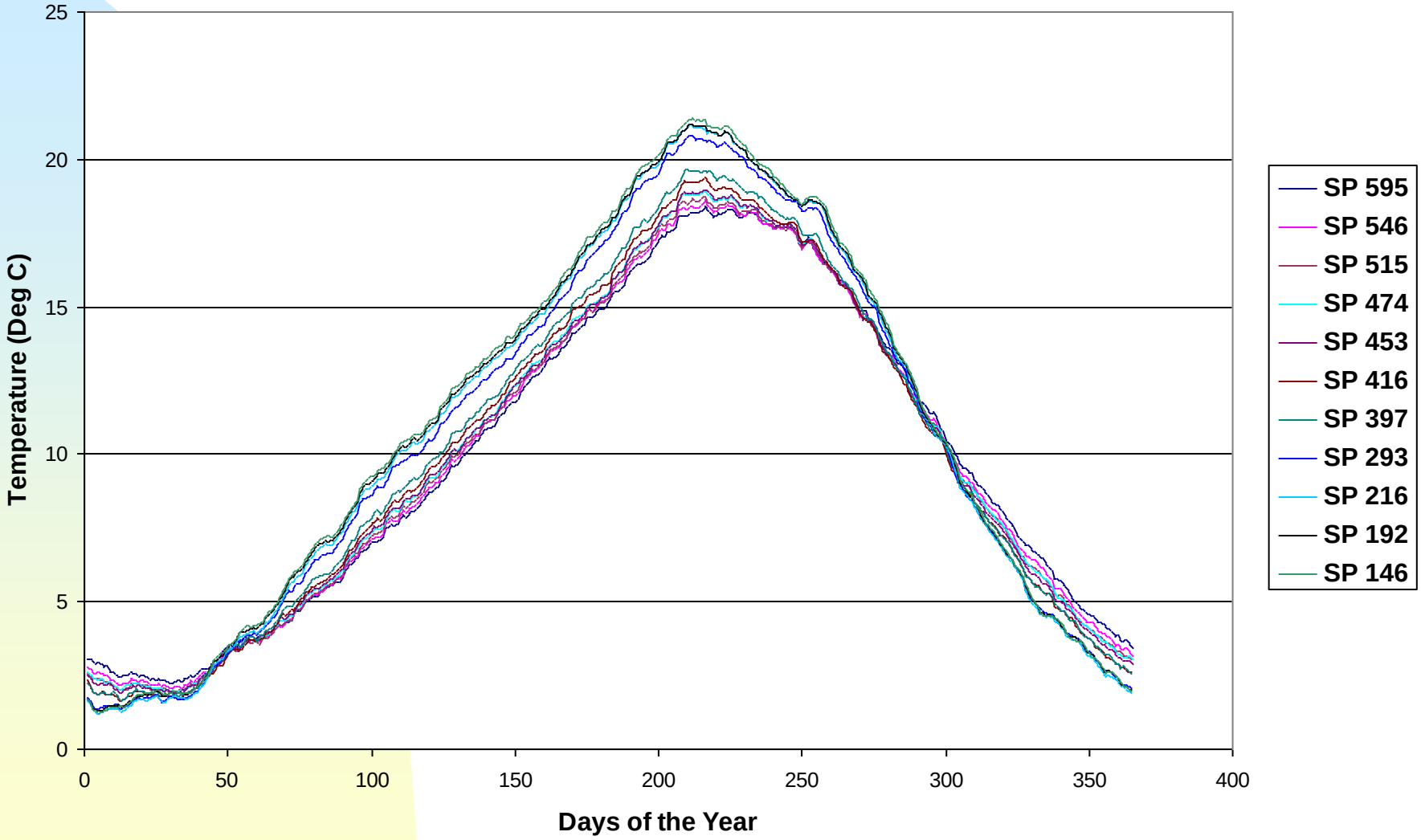
Columbia River Site Potential Temperatures at Each Target Site



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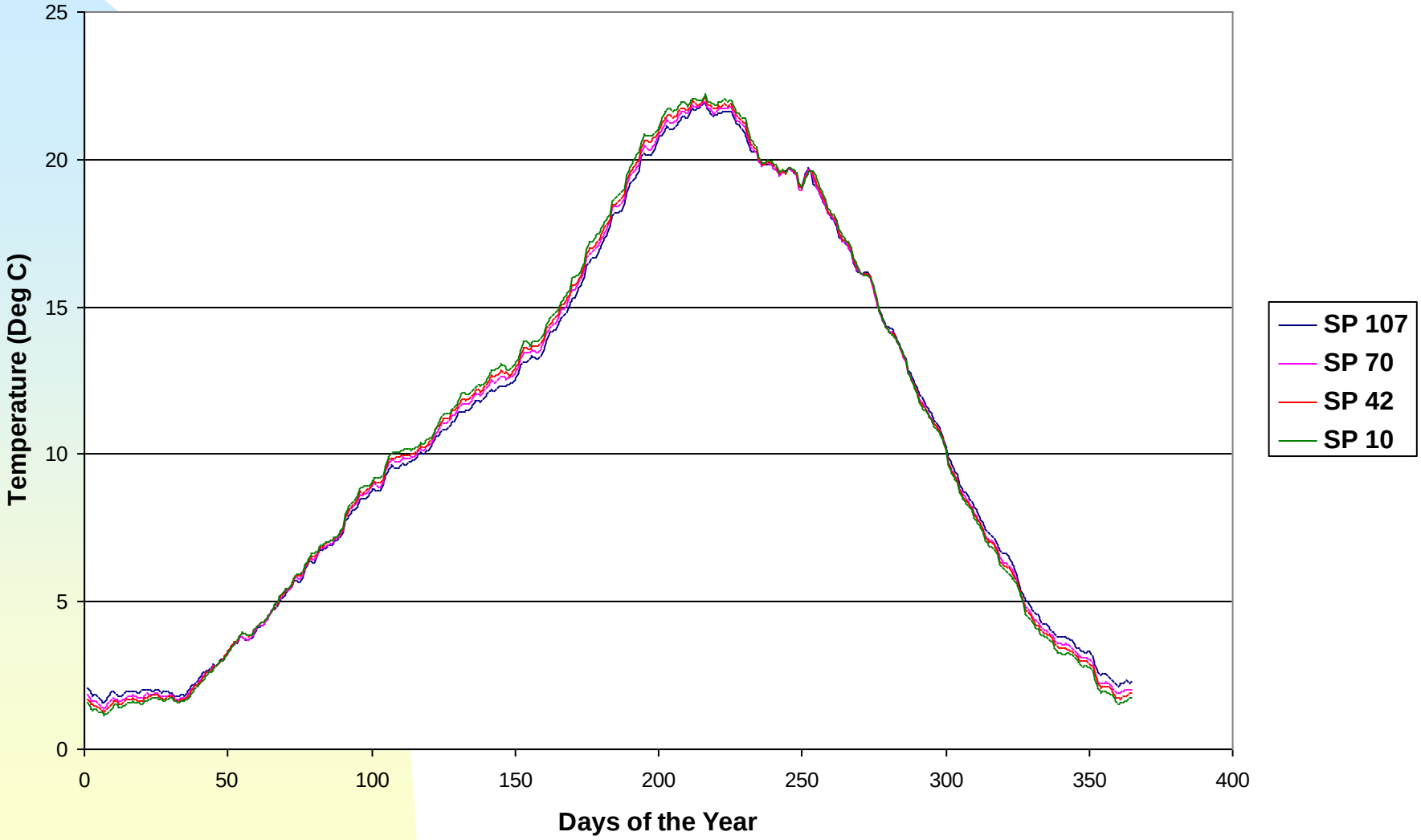
Snake River Site Potential Temperatures at Each Target Site



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Target Temperatures

- Apply Target Temperatures to the Average SP Reach by Reach.
- SP in the formulas = the 30 year average site potential for each day of the year.

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Target Temperatures

But…….

There's a catch!

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Target Temperatures

If we apply the WQS reach by reach to determine the target temperatures reach by reach we will exceed the target temperatures in the downstream reach.

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Columbia River Target Temperatures

River Reach	Criterion	SP<Criterion	SP>Criterion
Canadian Border to Grand Coulee			
	16 C	SP + 23/(T+5)	SP + 0.3 C
Grand Coulee to Chief Joseph			
	16 C	SP + 23/(T+5)	SP + 0.3 C
Chief Joseph to Priest Rapids			
	18 C	SP + 28/(T+7)	SP + 0.3 C
Priest Rapids to OR/WA Border			
	20 C	SP + 34/(T+9)	SP + 0.3 C
OR/WA Border to the Mouth			
	20 C	**SP + 1.1 C**	**SP + 0.14 C**

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Target Temperature

•We need to meet the more stringent WQS: in this case the standards in the lower reach along the border.

•So we need to determine the target temperature in the upstream reaches that will allow achievement of the target temperature in the lower reach.

•Ie: We have to allocate temperature among the upstream sources.

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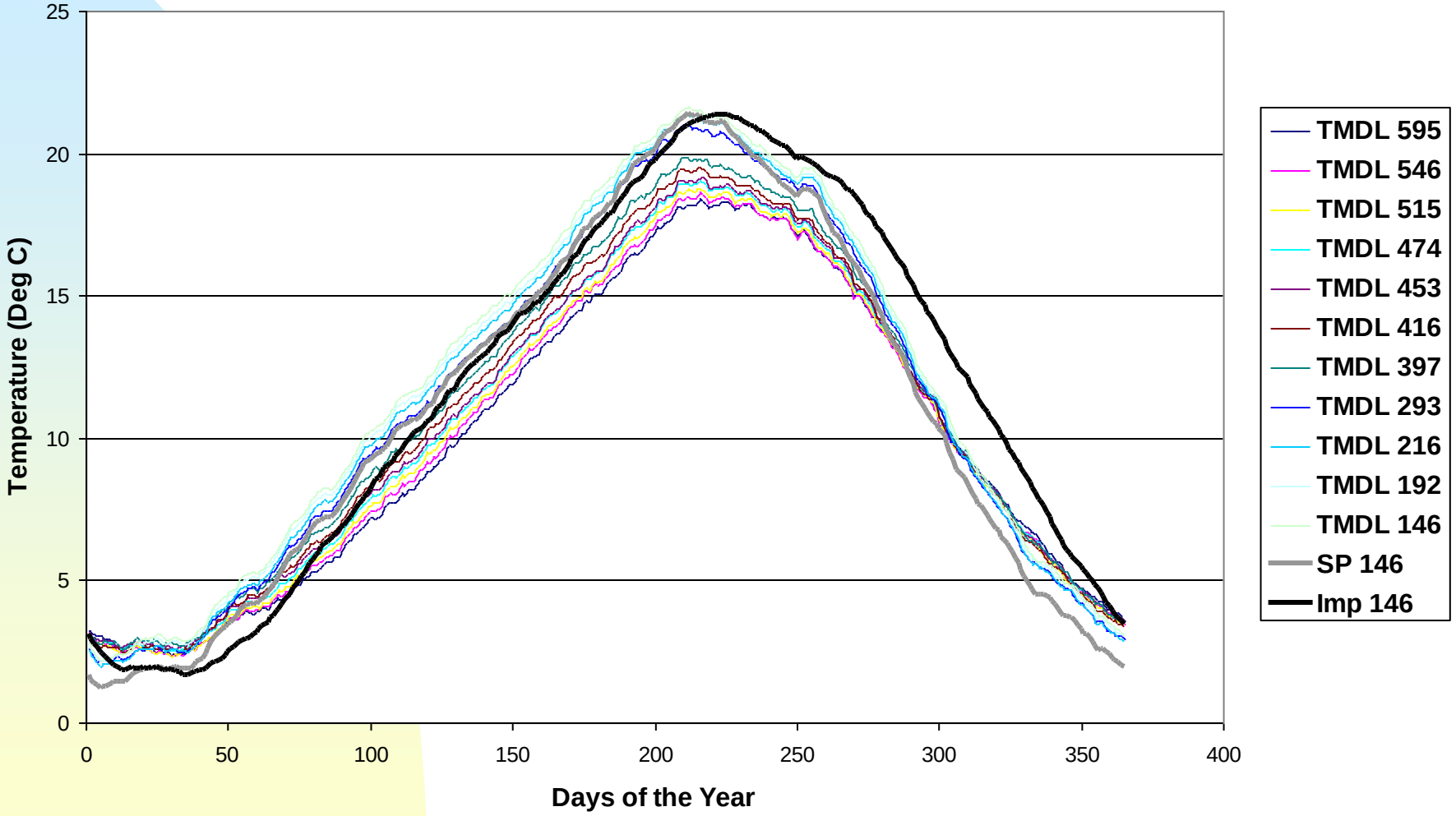
Columbia River TMDL Temperatures at Each Target Site with Bonneville Site Potential and Impounded Temperatures



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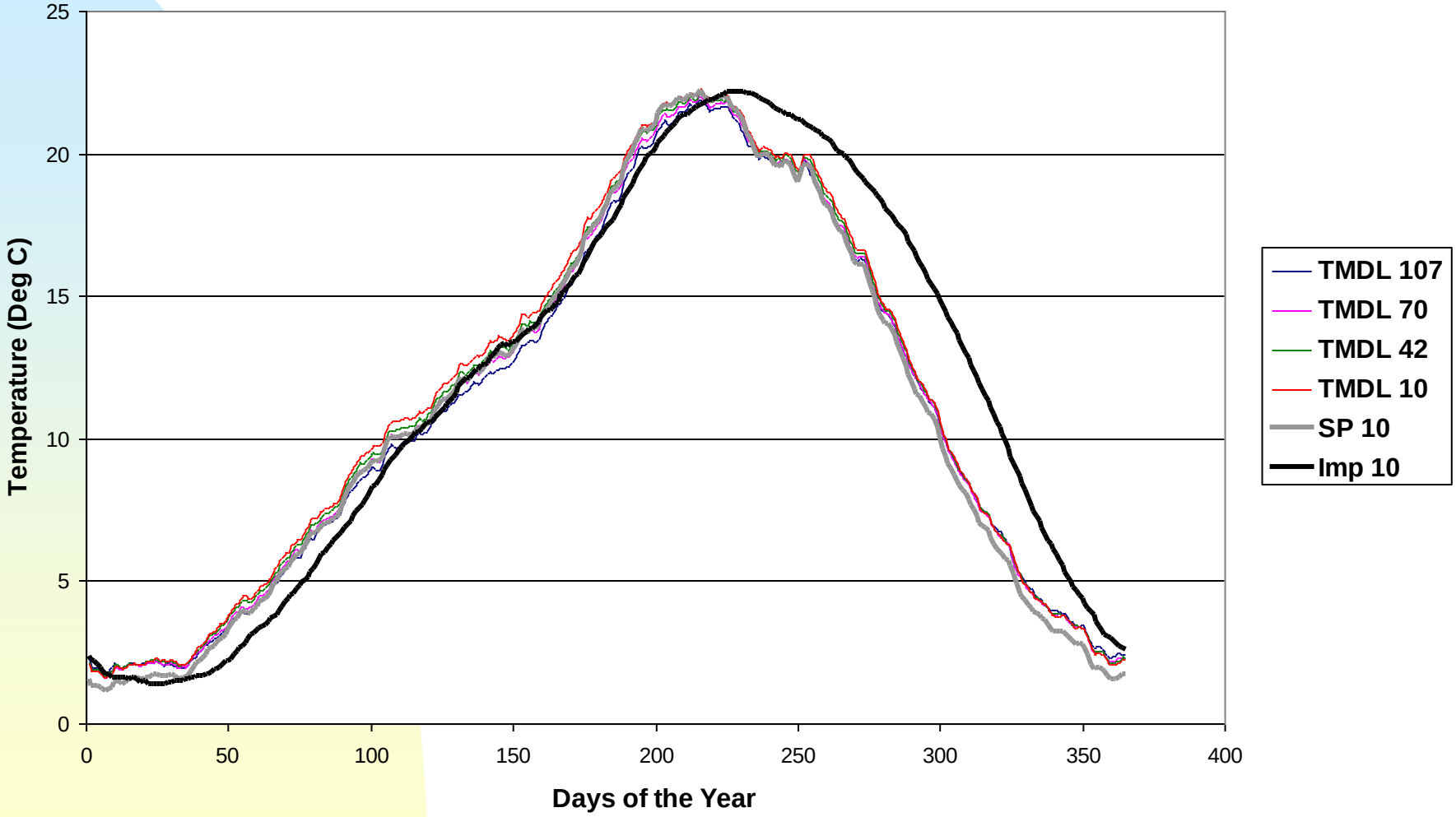
Snake River TMDL Temperatures at Each Target Site with Ice Harbor Site Potential and Impounded Temperatures



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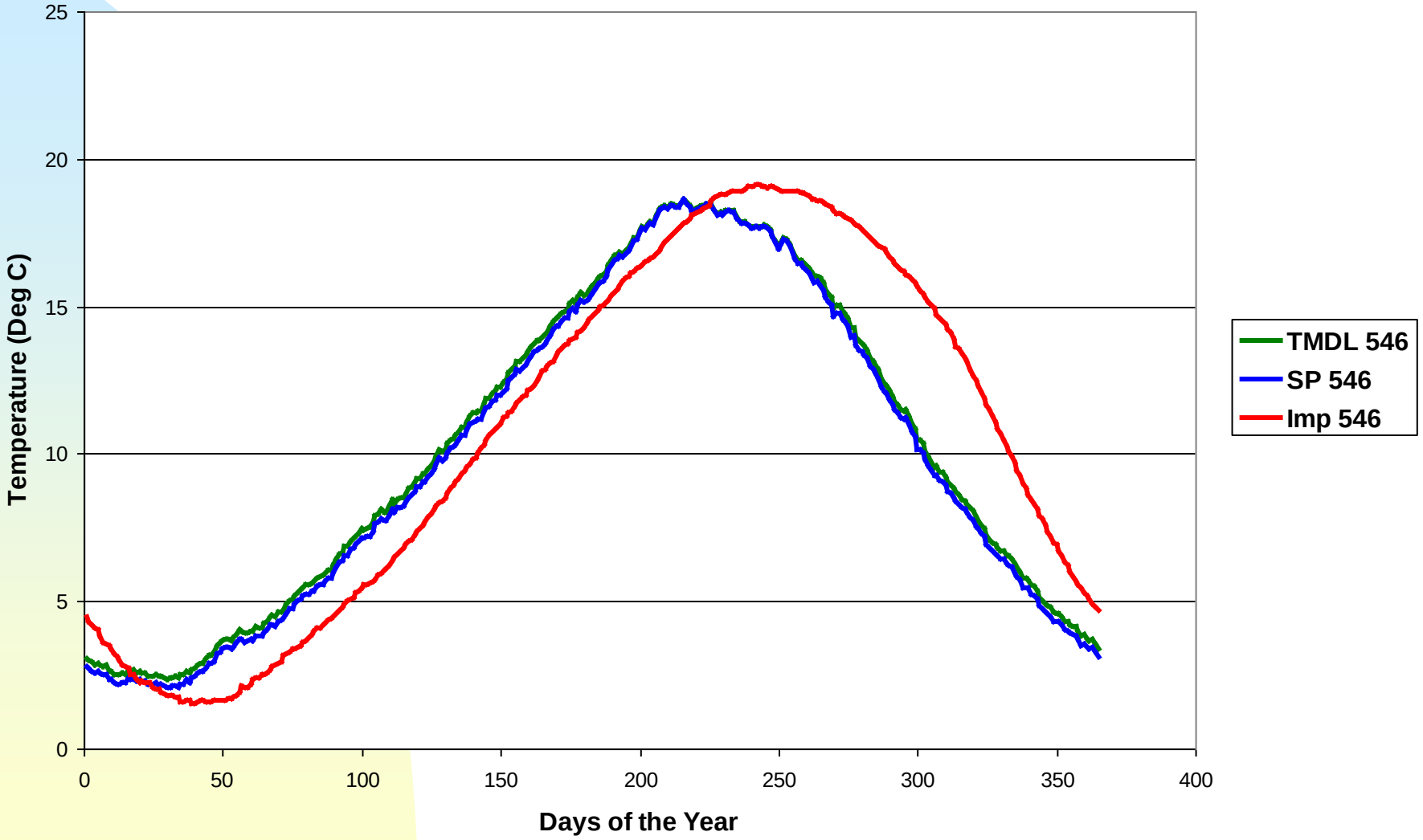
Chief Joseph Target, Site Potential and Impounded Temperatures



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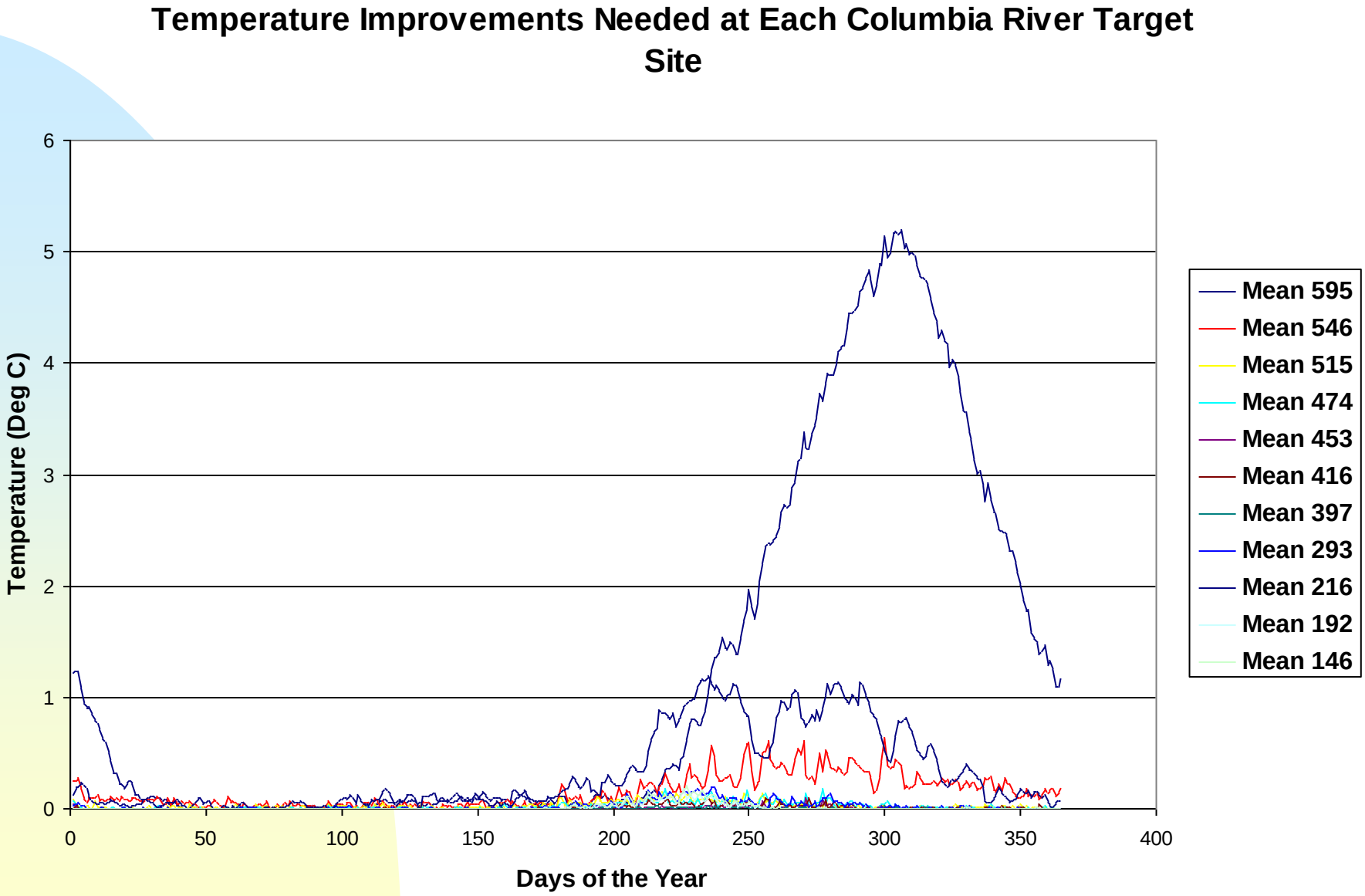
Approach 1



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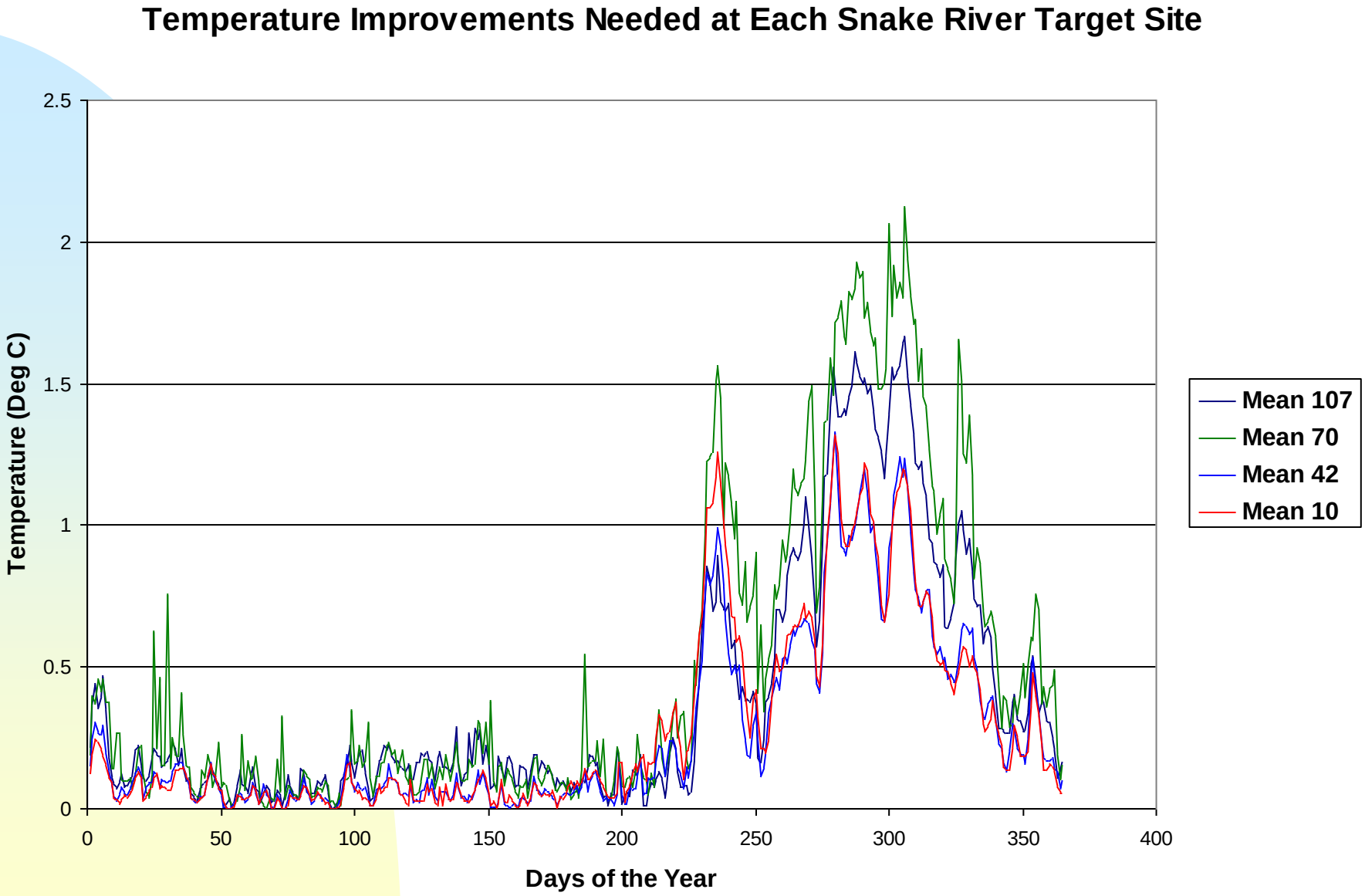
Approach 1



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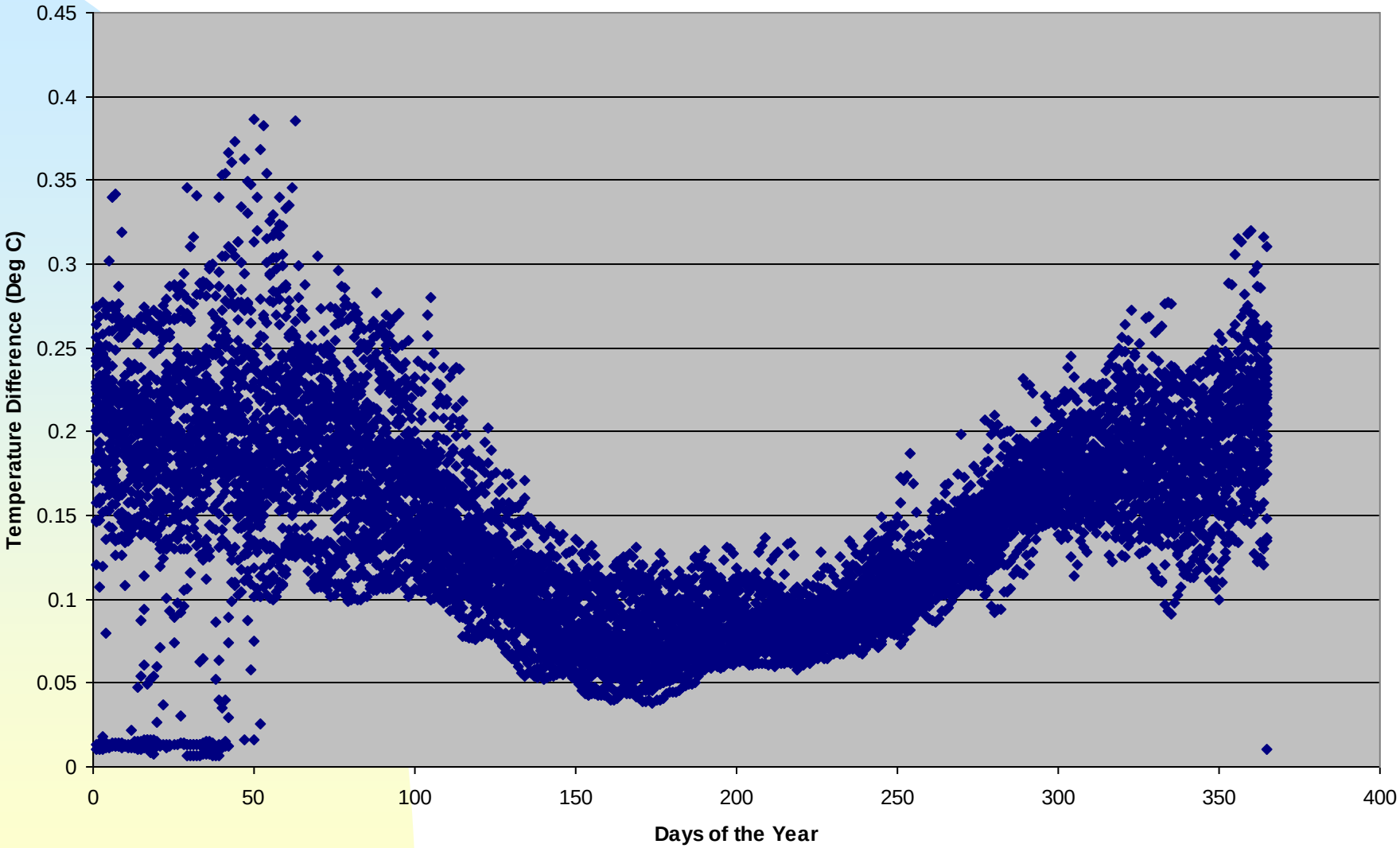
Temperature Differences at Columbia River Mile 42 Caused by Point Sources



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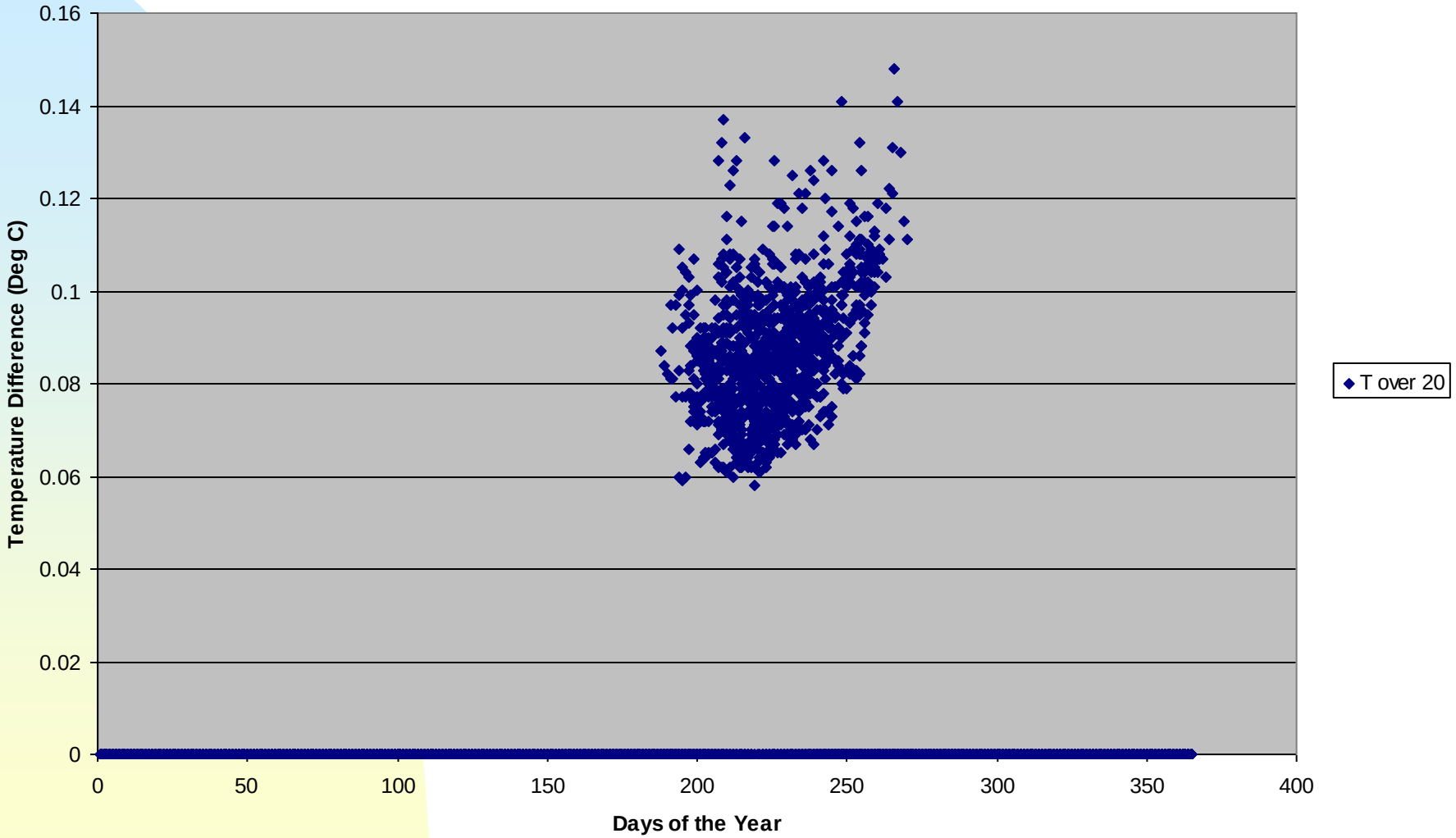
Temperature Differences at Columbia River Mile 42 Caused by Point Sources when the River Temperature Exceeds 20 Deg C



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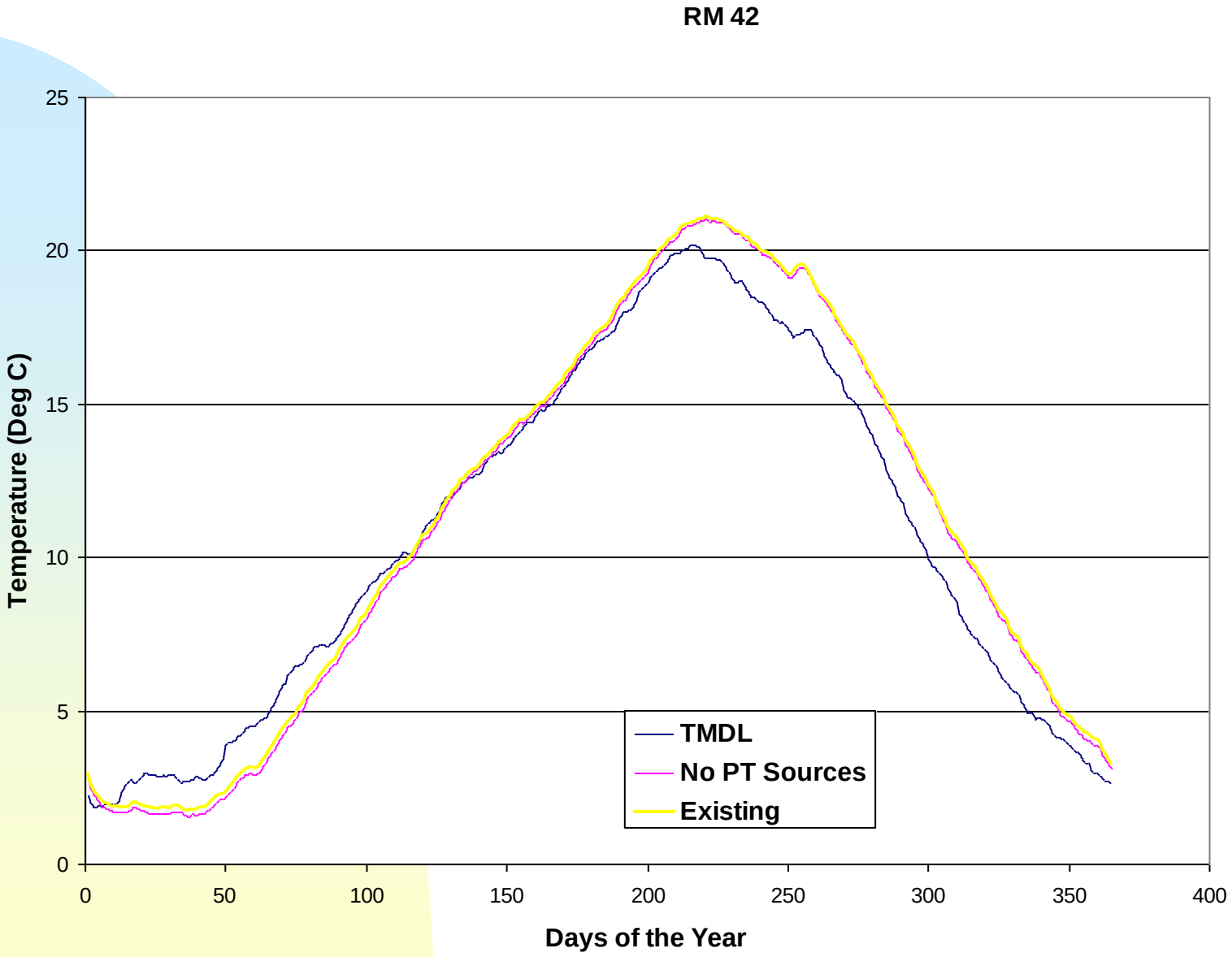

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We established the Target Temperatures for each reach based on the existing point source temperature effects.

There can be very little increase in temperature over that caused by existing point sources.

In fact, at each dam site the temperature can increase by 0.01 deg C in addition to that caused by point sources.

This will result in achievement of the 0.14 increase above site potential at RM 4.

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Establish Loading Capacity

- Loading Capacity in this TMDL is in terms of Temperature rather than thermal load.
- Temperature is being used as "another appropriate measure" as per the regulations.
- Thermal load is not used because the dams are the most significant causes of temperature change but they do not discharge a thermal load to the river and they can alter load without affecting temperature.

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Establish Loading Capacity

For this TMDL the Loading Capacity is the Target Temperature at RM 4.

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Allocate Available Load

The load available for allocation to dams, point sources, non-point sources, and future growth is the incremental increase allowed at each target site to achieve the target temperature:

0.01005 deg C at Grand Coulee

0.037 deg C at McNary

0.05 at RM 63

0.0100001 at Ice Harbor Dam

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Point Sources

- 106 Point Sources
- Most cause less than 0.014 C increase.

  Group allocation for these

- 13 Point Sources cause > 0.014 C increase.
- These will get individual allocations.

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Point Sources

If the WLA for point sources is based on existing discharge will have the following caveats:

•WLA will be based on actual discharge, not worst case estimates of thermal load or excess capacity in mixing zones

•Mixing zones will be assessed. Compliance at the edge of the mixing zone may, in some cases, constrain permits beyond the WLA in the TMDL.

•Sources will be required to meet the minimum levels of technology such as "All Known Available and Reasonable Technology" in WA.

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Tributaries

One Tributary, the Umatilla River, has a TMDL for Temp. It will get its TMDL allocations in this TMDL.

192 Tribs do not have TMDLs. They will get their existing loads. Small Tributaries with no data may get bubble loads.

30 Tribs are on the 303 (d) list for temp.

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Tributaries

- Essentially this TMDL is based on site potential in the main-stems.
- Water flowing into the TMDL from tributaries and boundary conditions is not at site potential.
- Improvement in temperature in the tributaries or at the boundary conditions could lower the site potential of the main-stems.
- We are doing an analysis of tributary temperature effects on main-stem site potential to develop thresholds of ΔT in the tributaries that would warrant re-opening this TMDL.

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Columbia Tributaries

	ΔT to Lower SP by 0.5 °C	ΔT to Lower SP by 0.14 °C
Spokane R.	7.0	1.9
Okanagan	17	4.9
Yakima R.	17	4.8

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Columbia Tributaries

	ΔT to Lower SP by 0.5 °C	ΔT to Lower SP by 0.14 °C
Deschutes	16	4.6
Willamette	3.2	0.92

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Snake Tributaries

	ΔT to Lower SP by 0.5 °C	ΔT to Lower SP by 0.14 °C
Grande Ronde	6.0	1.7

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Measuring Compliance

Long Term System Level Compliance:

•Compliance with the target temperatures. That is, mean water temperature at the target sites equals the target temperatures.

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Important Points

- Site Potential Temperatures
- Target Temperatures = Average Site Potential + increment from WQS
- The downstream WQS are more restrictive and drive the TMDL target temperatures in the mid-Columbia.
- The Load is expressed as Temperature
- The Loading Capacity = the Target Temperature
- Temperature available for allocation is the WQS increment.
- There are many ways to allocate Target Temperature among the sites.

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